HEALTHCARE DATA ANALYSIS

A PROJECT REPORT

Submitted by

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Under the Guidance of

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in partial fulfillment of the requirementsfor the degree of

BACHELOR OF TECHNOLOGY
in
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with specialization in CLOUD COMPUTING

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SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
KATTANKULATHUR- 603 203

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Department of Networking and Communications

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ABSTRACT

The health insurance industry is confronted with the challenge of managing large and varied datasets, which include customer health records, policy information, and data from third-party services. This complexity is compounded by the increasing demand for personalized insurance policies, precise risk assessments, and effective revenue optimization strategies. This project proposes a scalable data-driven approach using PySpark in Google Colab to tackle these issues through real-time data analysis and customer behavior modeling.

The methodology encompasses several key processes, such as data cleaning, predictive modeling, and clustering, all designed to enhance customer engagement and optimize revenue strategies. By leveraging PySpark MLlib for machine learning tasks and Tableau for data visualization, this framework facilitates the creation of personalized health insurance offerings, accurate risk assessments, and comprehensive insights into competitors.

The results highlight the successful application of Big Data techniques to improve decision-making, optimize pricing models, and deliver tailored services to customers. Ultimately, this project underscores the potential of advanced analytics in transforming the health insurance sector, leading to better customer experiences and increased revenue opportunities.

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LIST OF SYMBOLS AND ABBREVIATIONS

RDBMS - Relational Database Management System

HDFS - Hadoop Distributed File System

Sqoop - SQL to Hadoop (a tool for transferring data between relational databases and Hadoop)

JSON - JavaScript Object Notation

CSV - Comma-Separated Values

EDA - Exploratory Data Analysis

SQL - Structured Query Language

IoT - Internet of Things

Big Data - Large and complex data sets that traditional data processing software cannot deal with

API - Application Programming Interface (not directly mentioned but commonly used in contexts of data integration)

ML - Machine Learning (if referenced in the context of predictive analytics)

BI - Business Intelligence (if applicable in the context of data visualization)

PySpark - Python API for Apache Spark

INTRODUCTION

The health insurance industry is changing rapidly, and companies must find better ways to understand their customers and improve their revenue. One health insurance company has recognized that it struggles to analyze a lot of data from different sources, such as competitor information and customer behavior. This data comes from various methods, including web scraping and third-party services. By analyzing this information, the company hopes to create customized insurance offers for customers and calculate rewards for those who have purchased policies in the past.

This project will focus on several important aspects to help the company overcome these challenges. First, we will build data pipelines that collect and process information from multiple sources. This will include cleaning and preparing the data to make sure it is accurate and reliable. Next, we will use analytics techniques, like predictive modeling and clustering, to understand customer behavior and preferences. By identifying these patterns, the company can tailor its offers to better meet the needs of its customers.

Additionally, we will develop a way to monitor what competitors are doing, so the company can make smart decisions quickly. We will also use visualization tools like Tableau to present the insights clearly, making it easier for stakeholders to understand the data and adjust their strategies.

The main goal of this project is to help the healthcare insurance company boost its revenue by using data to make informed decisions. By analyzing customer behavior and creating personalized offers, the company can attract new clients and keep existing ones by rewarding their loyalty. This approach not only improves business strategies but also enhances customer satisfaction in a competitive market.

LITERATURE REVIEW

Table 2.1 – List of articles

S.No.	Title	Published in	Year	Benefits	Challenges
1.	Big Data for Personalized Health Monitoring	IEEE Access, Authors: John Smith, Emily Wang	2021	• Enables real-time analysis of health data to provide personalized recommendations. • Helps insurance companies tailor their policies for customers based on health data.	• Managing vast amounts of data. • Ensuring data privacy security.
2.	Data Mining in Healthcare: Current Applications	Journal of Healthcare Informatics Research, Authors: David Johnson, Maria Gomez	2020	• Analyzes health patterns in large datasets. • Improves early disease detection and prevention.	• Requires complex algorithms for accurate data mining • Ensuring the quality of data.
3.	Wellness Tracking with IoT and Big Data	IEEE Internet of Things Journal, Authors: Li Wei, Akash Patel	2022	• Combines IoT and Big Data to provide continuous health monitoring. • Better customer engagement for	• Integration between IoT devices and big data platforms. • Complex and costly.

				insurance companies.	
4.	Big Data Analytics in Healthcare: A Review	Journal of Biomedical Informatics, Authors: Sarah Lee, Oliver Harris	2020	• Helps insurers to predict customer health trends • Leads to better pricing models for insurance policies.	• High storage and computational power requirements. • Costly and time consuming.
5.	Predictive Analytics for Healthcare	Journal of Medical Systems, Authors: Rajeev Kumar, Yuki Takahashi	2021	• Enhances decision-making by predicting future health issues from past and current data. • Helps insurance companies mitigate risks.	• Data sensitivity and ethical concerns around predictive models need careful handling.
6.	Hadoop in Healthcare: Managing Big Data for Wellness	International Journal of Big Data, Authors: Michael Allen, Priya Rao	2019	• Helps insurers to collect and store large-scale customer health data efficiently • Faster data access.	• Complexity of managing diverse data types. • Ensuring fault-tolerance in data storage.
7.	Spark in Healthcare: Real-time Data Processing for Wellness	Journal of Data Science, Authors: Katherine	2021	• Enables real-time processing of large datasets for instant customer behavior analysis.	• Real-time processing systems can be prone to errors.

		Mitchell, Wei Zhang		• Improves policy recommendations.	• Require continuous maintenance.
8.	A Comparative Study on Big Data Ecosystem Tools for Healthcare	ACM Transactions on Data Science, Authors: Alex Brown, Nisha Verma	2022	• Compares various tools for analyzing customer data. • Helps insurers to choose the best technology stack.	• Choosing the right tool based on the business need is challenging and requires expertise.
9.	Privacy-Preserving Data Mining in Healthcare	IEEE Transactions on Big Data, Authors: Laura Green, Javier Martinez	2023	• Ensures that customer health data is analyzed while maintaining privacy, crucial for customer trust in insurance.	• Implementing privacy measures increases system complexity. • Can slow down data analysis.
10.	Machine Learning for Health Risk Prediction in Insurance	Journal of Health Informatics, Authors: Andrew Lee, Mei Chen	2022	• Utilizes machine learning models to predict health risks based on customer lifestyle and wellness data. • Helps insurance companies offer tailored policies.	• Ensuring that machine learning models are accurate and reliable can be difficult due to the complexity of health data.
11.	Analyzing Lifestyle Data for Insurance	Journal of Information Systems, Authors: Henry	2020	• Allows insurance companies to analyze lifestyle	• Data normalization and cleaning become

	Companies Using Apache Hive	Williams, Priya Nair		data trends at scale. • Customized health policies for customers.	challenging due to the variety of sources and formats.
12.	Customer Behavior Analysis for Health Insurance Using Big Data	International Journal of Health Data Science, Authors: Sophia Park, Rajat Gupta	2021	• Helps in analyzing customer behavior patterns to send personalized insurance offers. • Increases engagement and revenue.	• Data collection from diverse sources can be inconsistent and challenging to integrate.

PROPOSED METHODOLOGY

3.1. Proposed Methodology

To address the challenges faced by the Health Care insurance company in analyzing customer behavior and wellness trends, we propose a comprehensive methodology that utilizes Big Data tools and technologies for efficient data collection, processing, and analysis. The proposed solution involves building a scalable data pipeline that handles data from diverse sources, processes it, and visualizes key insights to inform business decisions. Below is the framework/architecture for the methodology:

3.1.1. Data Collection

We begin by gathering large volumes of structured and unstructured data from multiple sources:

- Third-party data providers (customer behavior and wellness trends)
- Web scraping techniques to gather competitor data
- Internal databases (existing customer records)

This data is transferred into a relational database for initial storage.

3.1.2. Data Ingestion using Apache Sqoop

The next step involves using Apache Sqoop to transfer the structured data from the relational database into Hadoop HDFS for distributed storage:

- Sqoop Import: We configure Sqoop to periodically transfer the data from the relational database into HDFS. The data is partitioned and stored for further processing.
- Data Scalability: Sqoop ensures scalable data ingestion, allowing us to handle the growing volume of customer and wellness-related data.

3.1.3. Data Processing and Transformation using Apache Spark

Once the data is loaded into HDFS, we use **Apache Spark** for processing and cleaning the data. The data processing pipeline includes:

- Data Cleaning: Using Spark to remove duplicate records, handle missing values, and fix formatting issues. This step ensures data consistency and reliability for further analysis.
- Data Transformation: Spark allows us to transform the data into a structured format that can be easily queried and analyzed. This includes restructuring fields and creating new variables that help understand customer behavior patterns.
- Incremental Updates: Spark handles incremental data loads from Sqoop, ensuring that the pipeline keeps up with real-time data changes.

3.1.4. Querying and Analyzing Data with Spark SQL

After data cleaning and transformation, Spark SQL is used to perform structured queries on the dataset:

- Customer Behavior Queries: We query the data to identify customer patterns, trends, and behaviors that are critical for personalizing offers.
- Wellness Trend Analysis: We analyze wellness-related data to predict future health outcomes, customer fitness patterns, and other insights that are valuable for the insurance company.
- Efficient Querying: Spark SQL allows us to run distributed SQL queries efficiently, making the analysis faster and scalable for large datasets.

3.1.5. Data Visualization using Tableau

The final step in our methodology is to visualize the processed data using Tableau:
- Behavior & Wellness Dashboards: We create interactive dashboards to display customer behavior insights and wellness trends in a visually appealing format.
- Key Metrics Visualization: Important metrics such as customer engagement, wellness scores, and predicted future health trends are visualized for easy interpretation.
- Business Decision Support: These visualizations provide actionable insights for the company's business strategies, enabling data-driven decisions to enhance customer engagement, calculate royalties, and improve revenue generation.

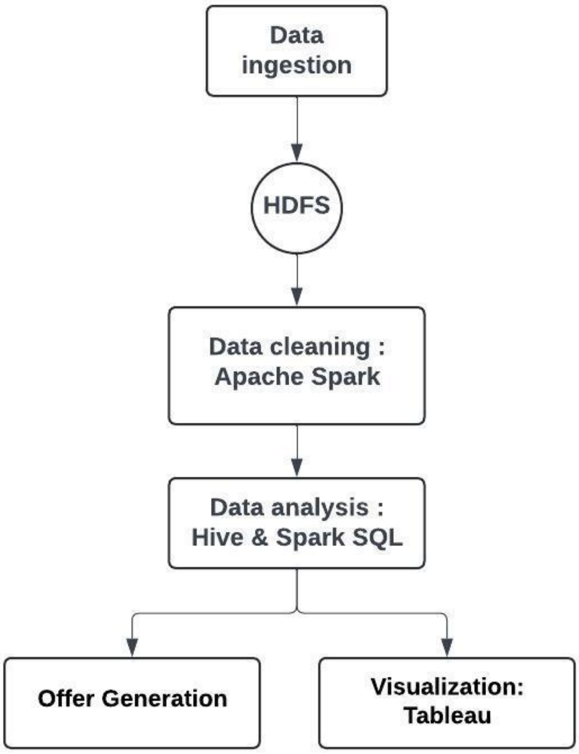

Data ingestion
HDFS
Data cleaning : Apache Spark
Data analysis : Hive & Spark SQL
Offer Generation
Visualization: Tableau

Fig 3.1- Proposed Model

By following this methodology, we effectively address the challenges the Health Care insurance company faces, ensuring they have the data insights needed to make informed, data-driven business decisions.

IMPLEMENTATION

4.1. Data Flow

-A file server receives data files in JSON and CSV formats. These files come from third-party sources based on how users interact with them.
-The data in these files is validated, enriched, and processed before being loaded into the RDBMS (Relational Database Management System).
-After validating the data, we create a data model for the RDBMS to store the information. Once the data is stored in the RDBMS, we transform it to meet our business needs.
-Finally, the data is transferred to HDFS (Hadoop Distributed File System) for analysis using analytical queries.
-After running the analytical queries, we test the results and use them to improve the company’s revenue.

4.2. Project Architecture

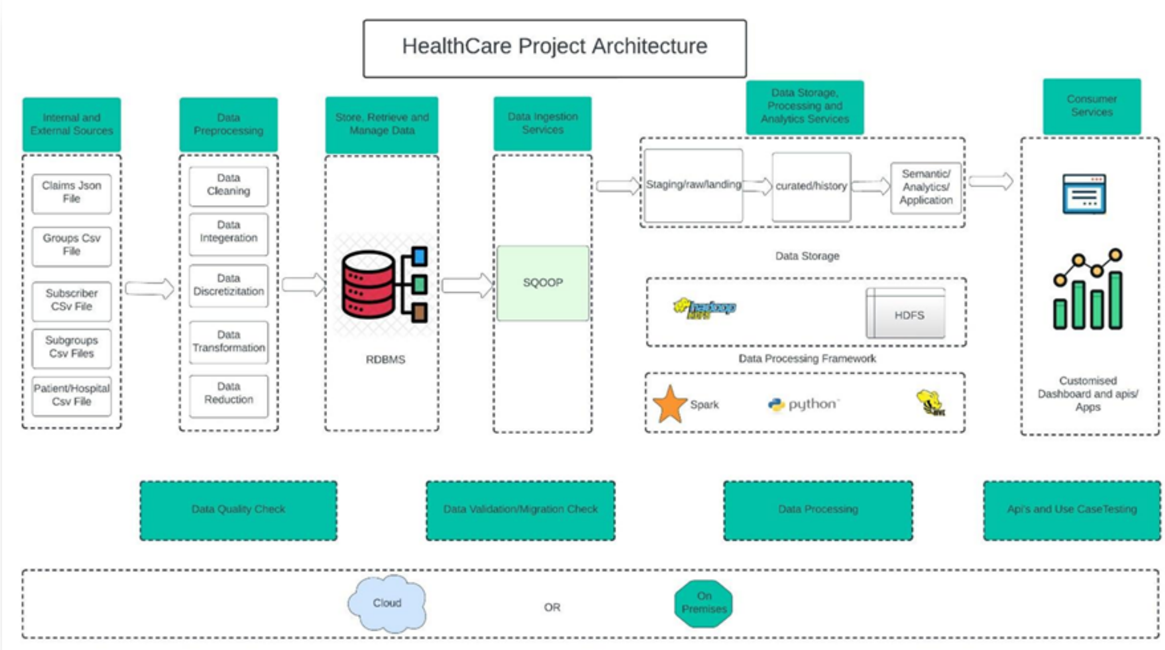


Fig 4.1- Project Architecture

4.3. Datasets

The JSON Files fields are given below :-

Details.json
● CLAIM_ID

● PATIENT_ID
● DISEASE_NAME
● SUB_ID
● CLAIM_DATE
● CLAIM_TYPE
● CLAIM_AMOUNT
● CLAIMED_OR_REJECTED

The CSV Files fields are given below :-

Patient.csv
● PATIENT_ID
● PATIENT_NAME
● PATIENT _GENDER
● PATIENT _BIRTHDATE
● PATIENT _PHONE
● HOSPITAL_ID
● DISEASE _ NAME
● CITY

Subscriber.csv
● SUB_ID
● FIRST_NAME
● LAST_NAME
● STREET
● BIRTH_DATE
● GENDER
● PHONE_NO
● COUNTRY
● CITY
● ZIP_CODE
● SUBGRP_ID
● ELIG_IND
● E_DATE
● T_DATE

Group.csv
● GRP_ID
● GRP_NAME
● PREMIUM_WRITTEN
● GRP_TYPE
● PIN_CODE
● CITY
● COUNTRY
● ESTABLISHMENT_YEAR

Disease.csv
● SUBGRP_ID
● DISEASE_NAME
● DISEASE_ID

Subgroup.csv
● SUBGRP_ID
● SUBGRP_NAME
● GRP_ID

Hospital.csv
● HOSPITAL_ID
● HOSPITAL _ NAME
● CITY
● STATE
● COUNTRY

Grpsubgrp.csv
● SUBGRP_ID
● GRP_ID

4.4. Steps

4.4.1 Data Pre-processing, Enrichment and Load into Database

Data was pre-processed, enriched, and loaded into the database.
● The schema of the given XML and CSV formats was parsed and inferred.
● General data cleaning steps were performed. These included replacing empty strings with actual NULL values, checking data types (including date formats), making corrections or rejections, checking file names, checking for empty files, and checking for malformed records.
The following rules were applied for the data enrichment process:
• The data from the input file was validated, and only valid records were loaded into the target table according to the constraints mentioned in the target table.
• Only members who were currently effective were loaded (i.e., SYSDATE was between EFFT_DT and TERM_DT).
• Records were rejected if the Subscriber_Id had fewer than 9 characters.
• Leading zeroes were populated in the fields GROUP_ID and SUBGRP_ID while loading data into the target table.
• The Group Id and Subgrp_Id were validated against the Subgrp table, and only matching data was loaded into the target table.

Code was written to clean and transform the data according to the use cases, and the cleaned data was saved inside the /Processed Data/files folder. After that, some exploratory data analysis (EDA) was performed on the cleaned data. Code was written and run to take data from /Processed Data/files and store all the files in the SQL database using Python and the MySQL connector.
● After that, some Sqoop scripts were written for importing data from the RDBMS system to the HDFS directory /user/hive/warehouse/HEALTHCARE.DB/files.

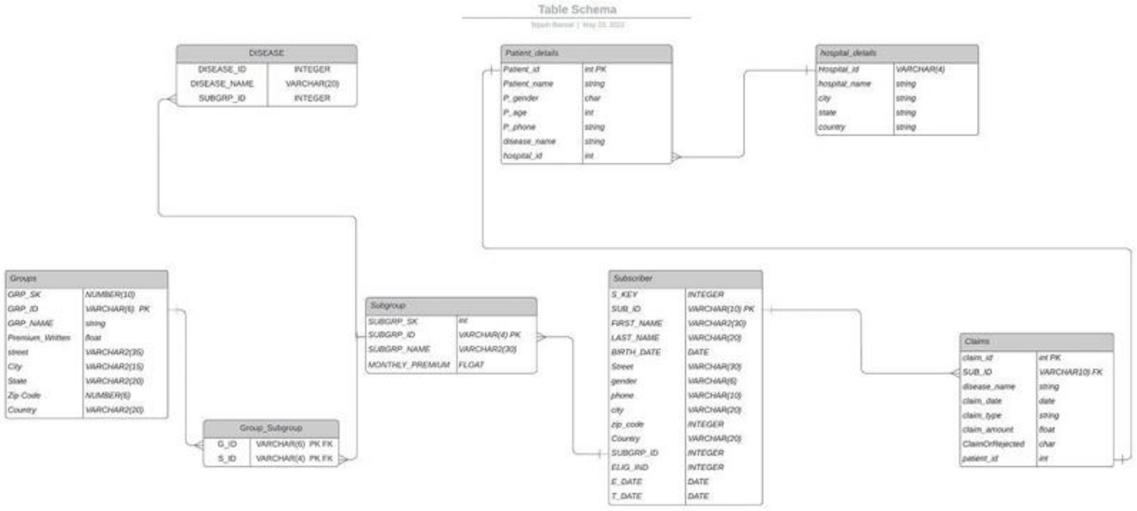


Figure 4.2 Schema Design for SQL Database

4.4.2 Data Analysis

Data analysis was performed using Spark/Hive.

Code was written and run to take data from /user/hive/warehouse/HEALTHCARE.DB/files and solve perform data analysis in a PySpark batch.

Once the data was made ready for analysis, the following analyses were conducted on a batch basis:

1. Subscribers who were under 30 and subscribed to any subgroup were found. The output was in the form of a file with the column COUNT_OF_SUBSCRIBER.
2. The groups of policies that subscribers mostly subscribed to—Government or Private—were identified. The output was in the form of a file with columns GRP_TYPE and COUNT(GRP_ID).
3. Female patients over the age of 40 who underwent knee surgery in the past year were listed. The output was in the form of a file with the column PATIENT_NAME.
4. The most profitable subgroup, which was subscribed to the greatest number of times, was identified. The output was in the form of a file with columns SUBGRP_NAME and COUNT.
5. The groups with the maximum number of subgroups (Policies Groups) were determined. The output was in the form of a file with columns G_ID and SUBGRP_COUNT.
6. The city from where most of the claims were coming was found. The output was in the form of a file with columns CITY and MAX_CLAIM.
7. Patients who were under 18 and admitted for cancer in the hospital were listed. The output was in the form of a file with columns PATIENT_ID, PATIENT_NAME, and AGE.

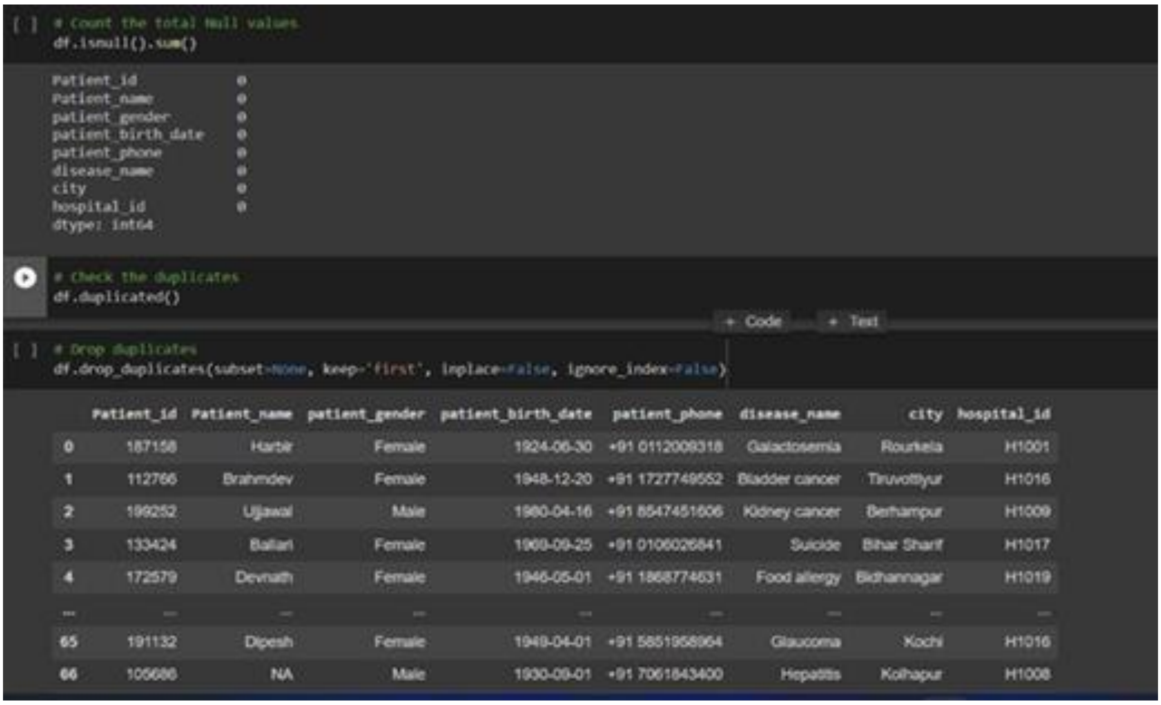
8. Patients who had cashless insurance and total charges greater than or equal to Rs. 50,000 were listed. The output was in the form of a file with columns PATIENT_NAME, PATIENT_GENDER, and PATIENT_BIRTH_DATE.
9. The total number of claims that were rejected by the groups (insurance companies) was found. The output was in the form of a file with columns CLAIM_OR_REJECTED and COUNT_CLAIM_ID.
10. The disease with the maximum number of claims was identified. The output was in the form of a file with columns DISEASE_NAME and COUNT_CLAIMS.

The above analyzed results were stored as a separate dataset in HDFS.
Code was written and run to take data from '/spark output/files' and perform some visualization on the output files.
At the end, all use cases were tested according to the business requirements.

4.5. Coding

4.5.1 Data Processing

For each raw file, we checked for empty values, duplicate entries, and other details, and then we turned it into a processed dataset.



```
[ ] # Count the total Null values
    df.isnull().sum()
```

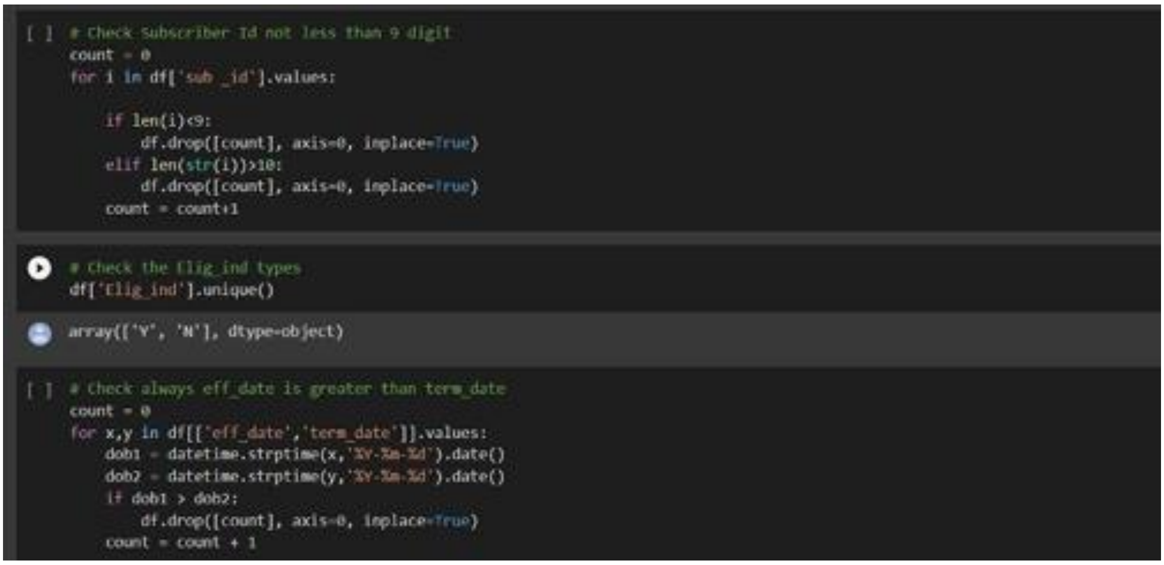
```
Patient_id            0
Patient_name          0
patient_gender        0
patient_birth_date    0
patient_phone         0
disease_name          0
city                  0
hospital_id           0
dtype: int64
```

```
# Check the duplicates
df.duplicated()
```

```
[ ] # Drop duplicates
    df.drop_duplicates(subset=None, keep='first', inplace=False, ignore_index=False)
```

	Patient_id	Patient_name	patient_gender	patient_birth_date	patient_phone	disease_name	city	hospital_id
0	187158	Harbir	Female	1924-06-30	+91 0112009318	Galactosemia	Rourkela	H1001
1	112766	Brahmdev	Female	1948-12-20	+91 1727749552	Bladder cancer	Tiruvottiyur	H1016
2	199252	Ujjawal	Male	1980-04-16	+91 8547451606	Kidney cancer	Berhampur	H1009
3	133424	Ballari	Female	1969-09-25	+91 0106026841	Suicide	Bihar Sharif	H1017
4	172579	Devnath	Female	1946-05-01	+91 1868774631	Food allergy	Bidhannagar	H1019
...	...	...	...	...	...	...	...	...
65	191132	Dipesh	Female	1949-04-01	+91 5851958964	Glaucoma	Kochi	H1016
66	105686	NA	Male	1930-09-01	+91 7061843400	Hepatitis	Kolhapur	H1008

Figure 4.5.1 Converting raw data to processed data



```
[ ] # Check Subscriber Id not less than 9 digit
    count = 0
    for i in df['sub _id'].values:

        if len(i)<9:
            df.drop([count], axis=0, inplace=True)
        elif len(str(i))>10:
            df.drop([count], axis=0, inplace=True)
        count = count+1
```

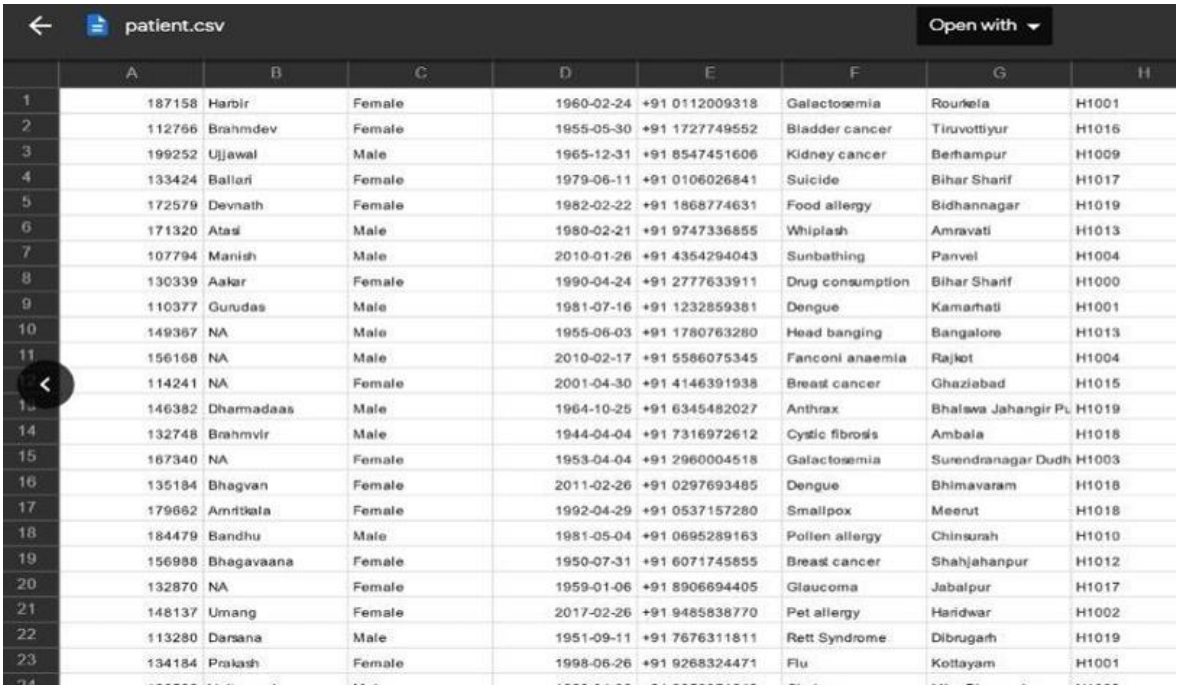
```
# Check the Elig_ind types
df['Elig_ind'].unique()
```

```
array(['Y', 'N'], dtype=object)
```

```
[ ] # Check always eff_date is greater than term_date
    count = 0
    for x,y in df[['eff_date','term_date']].values:
        dob1 = datetime.strptime(x,'%Y-%m-%d').date()
        dob2 = datetime.strptime(y,'%Y-%m-%d').date()
        if dob1 > dob2:
            df.drop([count], axis=0, inplace=True)
        count = count + 1
```

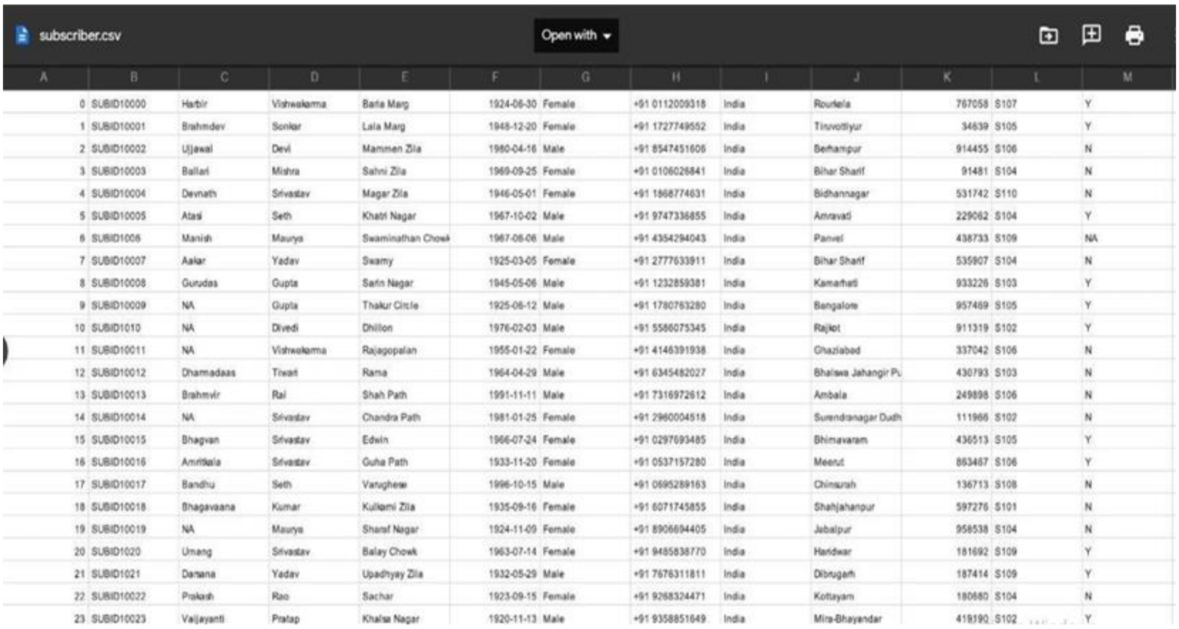
Figure 4.5.2 Checking for SUB_ID if is it length of 9

4.5.2 Processed Dataset



	A	B	C	D	E	F	G	H
1	187158	Harbir	Female	1960-02-24	+91 0112009318	Galactosemia	Rourkela	H1001
2	112766	Brahmdev	Female	1955-05-30	+91 1727749552	Bladder cancer	Tiruvottiyur	H1016
3	199252	Ujjawal	Male	1965-12-31	+91 8547451606	Kidney cancer	Berhampur	H1009
4	133424	Ballari	Female	1979-06-11	+91 0106026841	Suicide	Bihar Sharif	H1017
5	172579	Devnath	Female	1982-02-22	+91 1868774631	Food allergy	Bidhannagar	H1019
6	171320	Atasi	Male	1980-02-21	+91 9747336855	Whiplash	Amravati	H1013
7	107794	Manish	Male	2010-01-26	+91 4354294043	Sunbathing	Panvel	H1004
8	130339	Aakar	Female	1990-04-24	+91 2777633911	Drug consumption	Bihar Sharif	H1000
9	110377	Gurudas	Male	1981-07-16	+91 1232859381	Dengue	Kamarhati	H1001
10	149367	NA	Male	1955-06-03	+91 1780763280	Head banging	Bangalore	H1013
11	156168	NA	Male	2010-02-17	+91 5586075345	Fanconi anaemia	Rajkot	H1004
12	114241	NA	Female	2001-04-30	+91 4146391938	Breast cancer	Ghaziabad	H1015
13	146382	Dharmadaas	Male	1964-10-25	+91 6345482027	Anthrax	Bhalswa Jahangir Pu	H1019
14	132748	Brahmvir	Male	1944-04-04	+91 7316972612	Cystic fibrosis	Ambala	H1018
15	167340	NA	Female	1953-04-04	+91 2960004518	Galactosemia	Surendranagar Dudh	H1003
16	135184	Bhagvan	Female	2011-02-26	+91 0297693485	Dengue	Bhimavaram	H1018
17	179662	Amritkala	Female	1992-04-29	+91 0537157280	Smallpox	Meerut	H1018
18	184479	Bandhu	Male	1981-05-04	+91 0695289163	Pollen allergy	Chinsurah	H1010
19	156988	Bhagavaana	Female	1950-07-31	+91 6071745855	Breast cancer	Shahjahanpur	H1012
20	132870	NA	Female	1959-01-06	+91 8906694405	Glaucoma	Jabalpur	H1017
21	148137	Umang	Female	2017-02-26	+91 9485838770	Pet allergy	Haridwar	H1002
22	113280	Darsana	Male	1951-09-11	+91 7676311811	Rett Syndrome	Dibrugarh	H1019
23	134184	Prakash	Female	1998-06-26	+91 9268324471	Flu	Kottayam	H1001

Figure 4.5.3 Processed Dataset



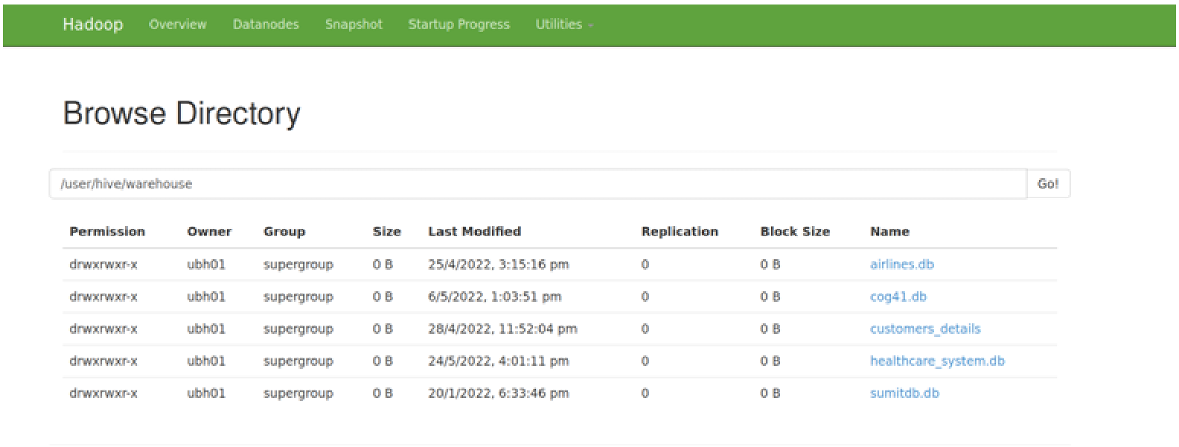
subscriber.csv

A	B	C	D	E	F	G	H	I	J	K	L	M
0	SUBID10000	Harbir	Vishwakarma	Baria Marg	1924-06-30	Female	+91 0112009318	India	Rourkela	767058	S107	Y
1	SUBID10001	Brahmdev	Sonkar	Lala Marg	1948-12-20	Female	+91 1727749552	India	Tiruvottiyur	34639	S105	Y
2	SUBID10002	Ujjawal	Devi	Mammen Zila	1980-04-16	Male	+91 8547451606	India	Berhampur	914455	S106	N
3	SUBID10003	Ballari	Mishra	Sahni Zila	1969-09-25	Female	+91 0106026841	India	Bihar Sharif	91481	S104	N
4	SUBID10004	Devnath	Srivastav	Magar Zila	1946-05-01	Female	+91 1868774631	India	Bidhannagar	531742	S110	N
5	SUBID10005	Atasi	Seth	Khatri Nagar	1967-10-02	Male	+91 9747336855	India	Amravati	229062	S104	Y
6	SUBID1006	Manish	Maurya	Swaminathan Chowk	1967-06-06	Male	+91 4354294043	India	Panvel	438733	S109	NA
7	SUBID10007	Aakar	Yadav	Swamy	1925-03-05	Female	+91 2777633911	India	Bihar Sharif	535907	S104	N
8	SUBID10008	Gurudas	Gupta	Sarin Nagar	1945-05-06	Male	+91 1232859381	India	Kamarhati	933226	S103	Y
9	SUBID10009	NA	Gupta	Thakur Circle	1925-06-12	Male	+91 1780763280	India	Bengalore	957469	S105	Y
10	SUBID1010	NA	Divedi	Dhillon	1976-02-03	Male	+91 5586075345	India	Rajkot	911319	S102	Y
11	SUBID10011	NA	Vishwakarma	Rajagopalan	1955-01-22	Female	+91 4146391938	India	Ghaziabad	337042	S106	N
12	SUBID10012	Dhamadaas	Tiwari	Rama	1964-04-29	Male	+91 6345482027	India	Bhalswa Jahangir Pu	430793	S103	N
13	SUBID10013	Brahmvir	Rai	Shah Path	1991-11-11	Male	+91 7316972612	India	Ambala	249898	S106	N
14	SUBID10014	NA	Srivastav	Chandra Path	1981-01-25	Female	+91 2960004518	India	Surendranagar Dudh	111966	S102	N
15	SUBID10015	Bhagvan	Srivastav	Edwin	1966-07-24	Female	+91 0297693485	India	Bhimavaram	436513	S105	Y
16	SUBID10016	Amritkala	Srivastav	Guha Path	1933-11-20	Female	+91 0537157280	India	Meerut	863467	S106	Y
17	SUBID10017	Bandhu	Seth	Varughese	1996-10-15	Male	+91 0695289163	India	Chinsurah	136713	S108	N
18	SUBID10018	Bhagavaana	Kumar	Kulkarni Zila	1935-09-16	Female	+91 6071745855	India	Shahjahanpur	597276	S101	N
19	SUBID10019	NA	Maurya	Sharaf Nagar	1924-11-09	Female	+91 8906694405	India	Jabalpur	958538	S104	N
20	SUBID1020	Umang	Srivastav	Balay Chowk	1963-07-14	Female	+91 9485838770	India	Haridwar	181692	S109	Y
21	SUBID1021	Darsana	Yadav	Upadhyay Zila	1932-05-29	Male	+91 7676311811	India	Dibrugarh	187414	S109	Y
22	SUBID10022	Prakash	Rao	Sachar	1923-09-15	Female	+91 9268324471	India	Kottayam	180680	S104	N
23	SUBID10023	Vaijayanti	Pratap	Khalsa Nagar	1920-11-13	Male	+91 9358851649	India	Mira-Bhayandar	418190	S102	Y

Figure 4.5.4 Processed Dataset

4.5.3 Hive and Sqoop

We have used Sqoop to import the data form RDBMS to Hive and there we can perform our necessary tasks to get the outputs.

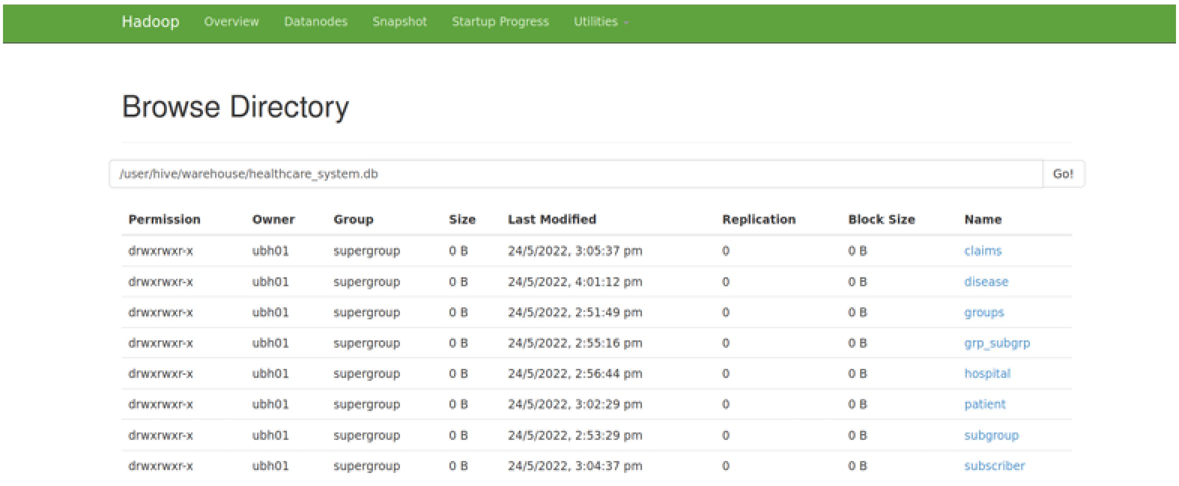


Browse Directory

/user/hive/warehouse

Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
drwxrwxr-x	ubh01	supergroup	0 B	25/4/2022, 3:15:16 pm	0	0 B	airlines.db
drwxrwxr-x	ubh01	supergroup	0 B	6/5/2022, 1:03:51 pm	0	0 B	cog41.db
drwxrwxr-x	ubh01	supergroup	0 B	28/4/2022, 11:52:04 pm	0	0 B	customers_details
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 4:01:11 pm	0	0 B	healthcare_system.db
drwxrwxr-x	ubh01	supergroup	0 B	20/1/2022, 6:33:46 pm	0	0 B	sumitdb.db

Figure 4.5.5 HEALTHCARE_SYSTEM Database created in Hive



Browse Directory

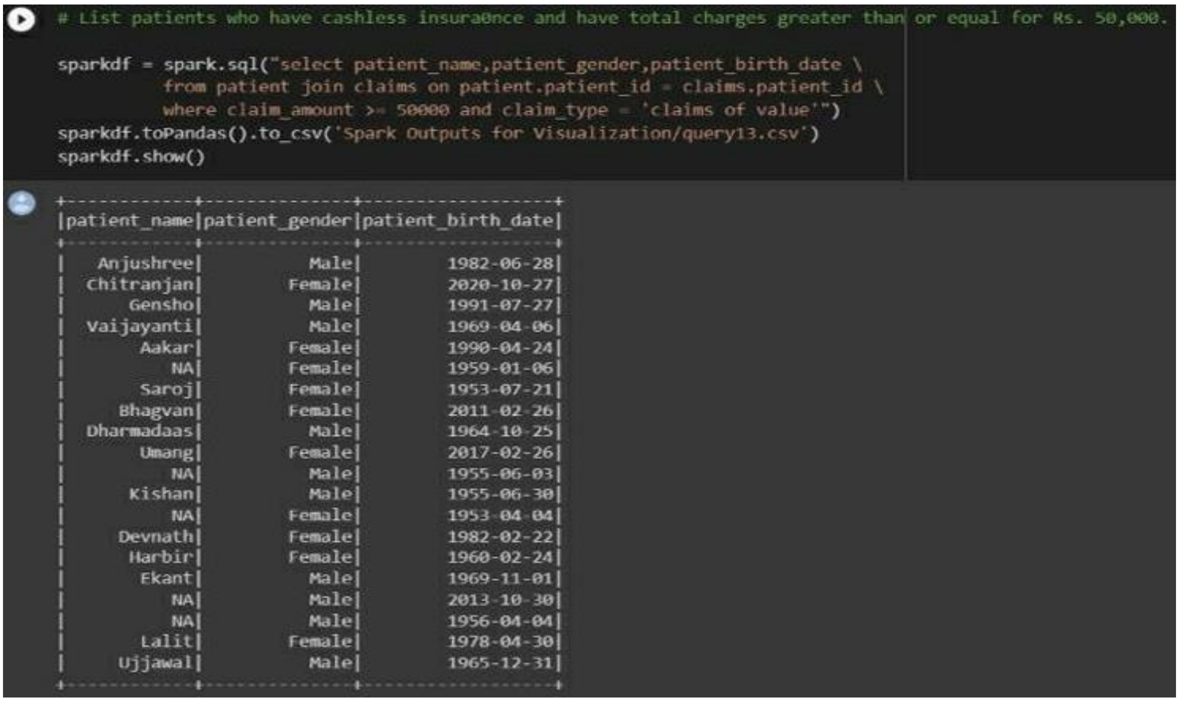
/user/hive/warehouse/healthcare_system.db Go!

Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 3:05:37 pm	0	0 B	claims
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 4:01:12 pm	0	0 B	disease
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 2:51:49 pm	0	0 B	groups
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 2:55:16 pm	0	0 B	grp_subgrp
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 2:56:44 pm	0	0 B	hospital
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 3:02:29 pm	0	0 B	patient
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 2:53:29 pm	0	0 B	subgroup
drwxrwxr-x	ubh01	supergroup	0 B	24/5/2022, 3:04:37 pm	0	0 B	subscriber

Figure 4.5.6 Tables created in the databases

4.5.4 Apache Spark

After uploading the data to HDFS, we connected Spark. We analyzed the data using Python. This process gave us the results in a table format, which we used to visualize our use cases.

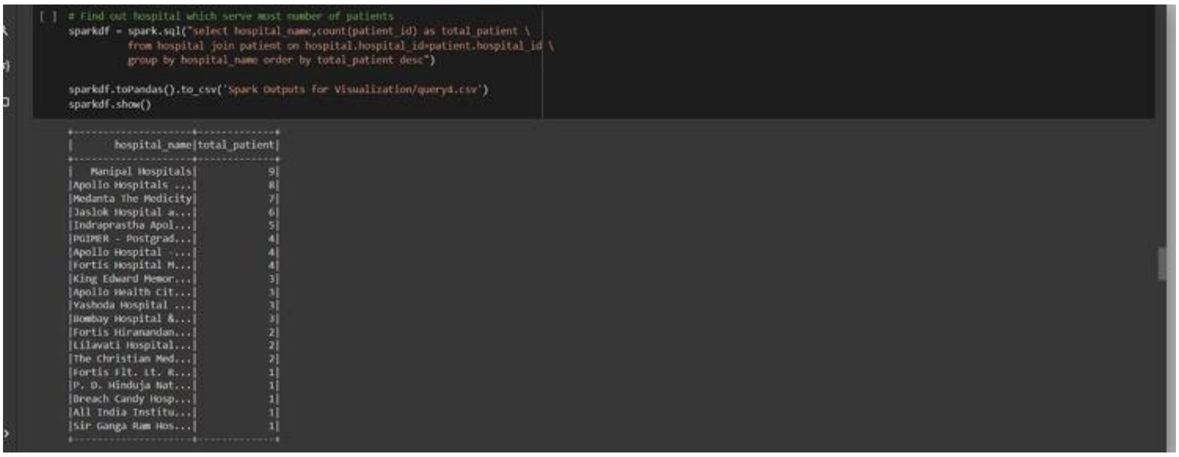


```
# List patients who have cashless insura0nce and have total charges greater than or equal for Rs. 50,000.

sparkdf = spark.sql("select patient_name,patient_gender,patient_birth_date \
          from patient join claims on patient.patient_id = claims.patient_id \
          where claim_amount >= 50000 and claim_type = 'claims of value'")
sparkdf.toPandas().to_csv('Spark Outputs for Visualization/query13.csv')
sparkdf.show()
```

```
+------------+--------------+------------------+
|patient_name|patient_gender|patient_birth_date|
+------------+--------------+------------------+
|   Anjushree|          Male|        1982-06-28|
|  Chitranjan|        Female|        2020-10-27|
|      Gensho|          Male|        1991-07-27|
|  Vaijayanti|          Male|        1969-04-06|
|       Aakar|        Female|        1990-04-24|
|          NA|        Female|        1959-01-06|
|       Saroj|        Female|        1953-07-21|
|     Bhagvan|        Female|        2011-02-26|
|  Dharmadaas|          Male|        1964-10-25|
|       Umang|        Female|        2017-02-26|
|          NA|          Male|        1955-06-03|
|      Kishan|          Male|        1955-06-30|
|          NA|        Female|        1953-04-04|
|     Devnath|        Female|        1982-02-22|
|      Harbir|        Female|        1960-02-24|
|       Ekant|          Male|        1969-11-01|
|          NA|          Male|        2013-10-30|
|          NA|          Male|        1956-04-04|
|       Lalit|        Female|        1978-04-30|
|     Ujjawal|          Male|        1965-12-31|
+------------+--------------+------------------+
```

Figure 4.5.7 Data visualization



```
# Find out hospital which serve most number of patients
sparkdf = spark.sql("select hospital_name,count(patient_id) as total_patient \
          from hospital join patient on hospital.hospital_id=patient.hospital_id \
          group by hospital_name order by total_patient desc")

sparkdf.toPandas().to_csv('Spark Outputs for Visualization/query4.csv')
sparkdf.show()
```

```
+--------------------+-------------+
|       hospital_name|total_patient|
+--------------------+-------------+
|   Manipal Hospitals|            9|
|Apollo Hospitals ...|            8|
|Medanta The Medicity|            7|
|Jaslok Hospital a...|            6|
|Indraprastha Apol...|            5|
|PGIMER - Postgrad...|            4|
|Apollo Hospital  ...|            4|
|Fortis Hospital M...|            4|
|King Edward Memor...|            3|
|Apollo Health Cit...|            3|
|Yashoda Hospital ...|            3|
|Bombay Hospital &...|            3|
|Fortis Hiranandan...|            2|
|Lilavati Hospital...|            2|
|The Christian Med...|            2|
|Fortis Flt. Lt. R...|            1|
|P. D. Hinduja Nat...|            1|
|Breach Candy Hosp...|            1|
|All India Institu...|            1|
|Sir Ganga Ram Hos...|            1|
+--------------------+-------------+
```

Figure 4.5.8 Data visualization

RESULTS

We used Matplotlib and Seaborn to visualize our use cases which will be better to take business decision.

5.1. Use Cases

5.1.1 Use Case-1: Average Monthly premium for each subgroup

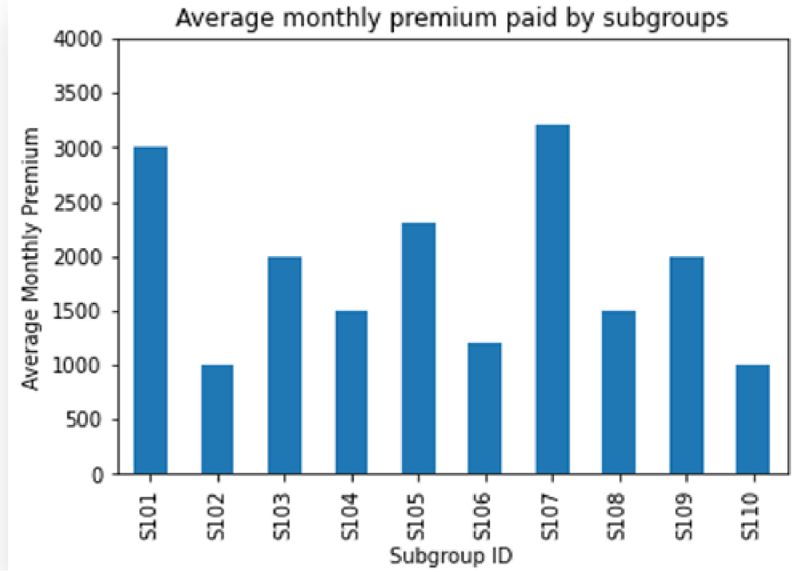


Figure 5.1.1 Average Monthly Premium

Use Case-2: Number of people whose claim either got accepted or rejected.

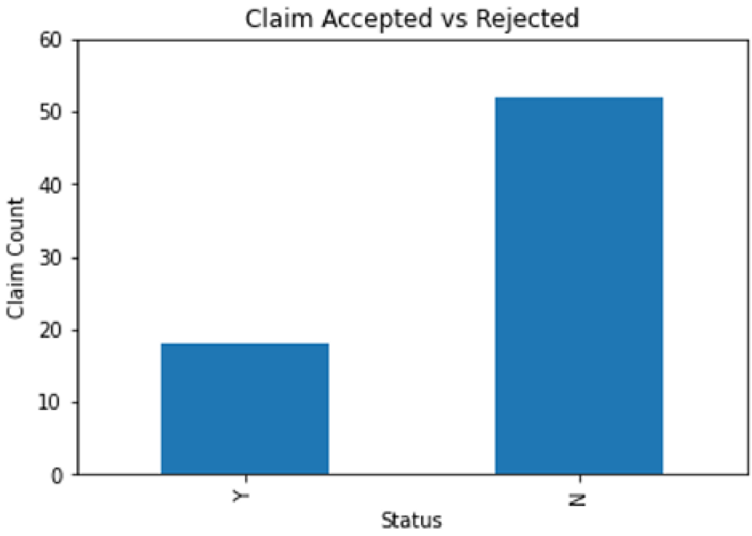


Figure 5.1.2 Claim Accepted vs Rejected

Use case-3: Which disease have maximum number of claims

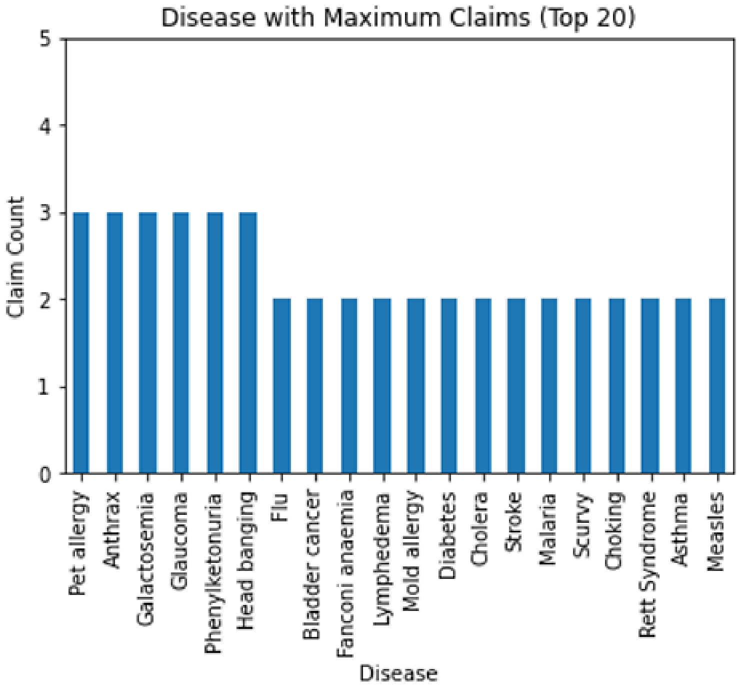


Figure 5.1.3 Disease with Maximum Claims

Use Case-4: Which company/group is most profitable

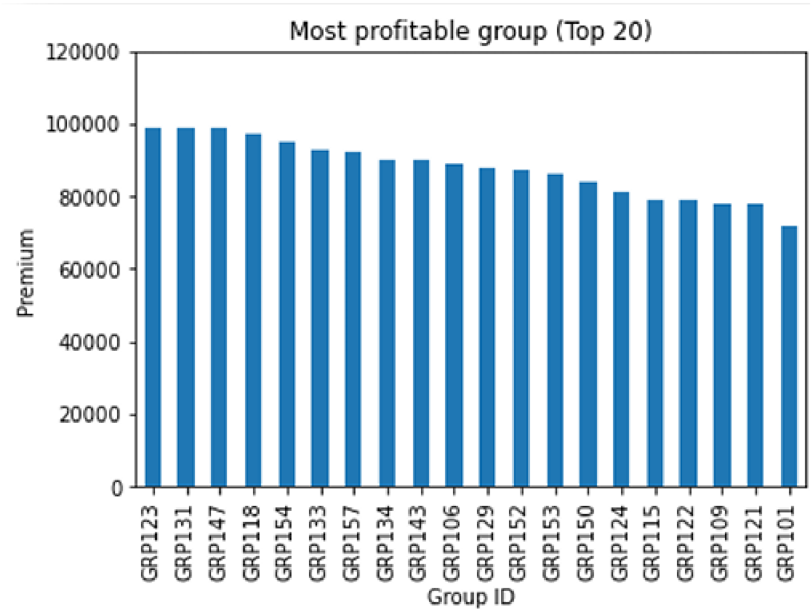


Figure 5.1.4 Most Profitable Group

Use case-5: No. of patient in each hospital

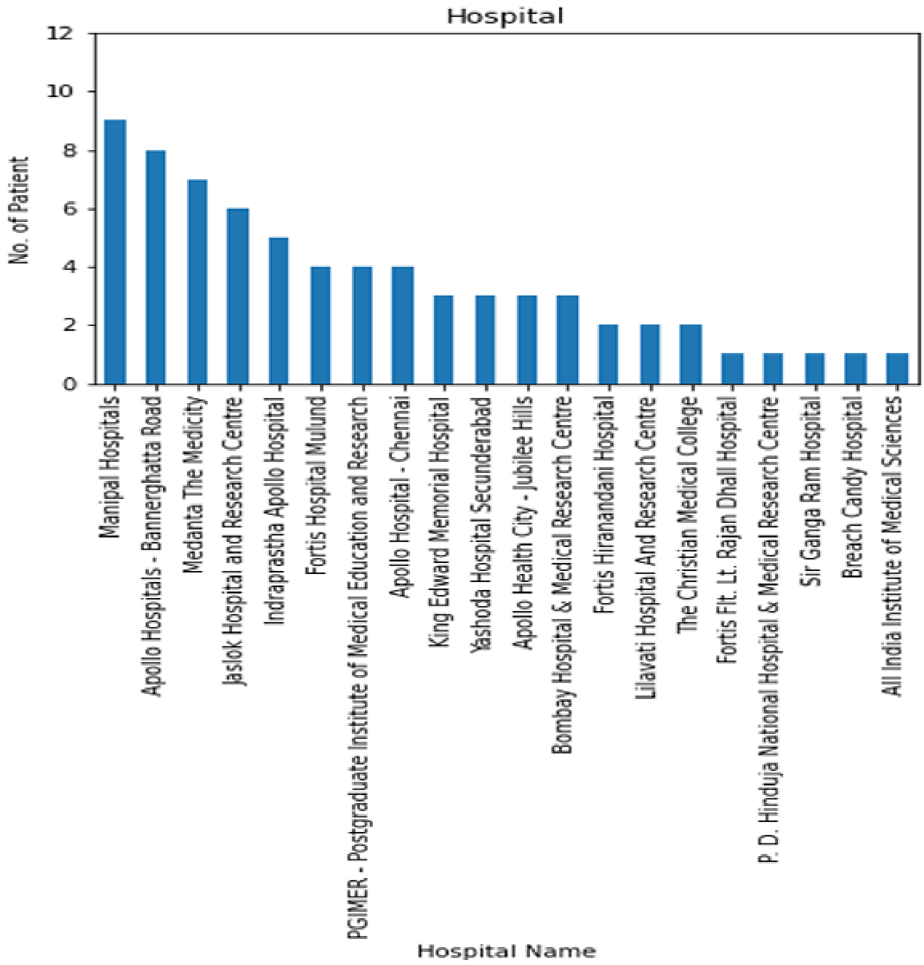


Figure 5.1.4 No. of Patients

Use case-6: Average Monthly premium paid by each subgroup.

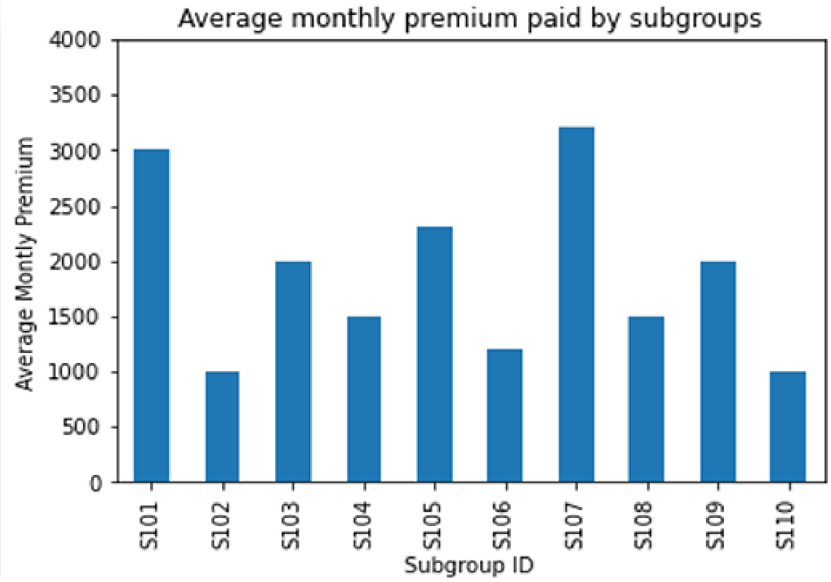


Figure 5.1.4 Average Monthly Premium paid by Subgroups

CONCLUSION

In conclusion, this project effectively tackles the challenges faced by the health insurance company in analyzing diverse data from various third-party sources. By leveraging Big Data tools, we processed and computed the data to visualize essential use cases. The insights gained from our analysis will enable the company to develop a new business strategy aimed at acquiring more customers, increasing engagement, and delivering targeted offers. Additionally, we have facilitated easy access to customer information, improving overall operational efficiency.

Looking ahead, this project has significant potential for further enhancements. While developed to meet our client's specific requirements, the framework can be generalized for broader applications across industries. With the necessary resources, we can achieve even more accurate results. Future opportunities include utilizing real-time data for immediate processing, automating data collection and execution, and adapting the approach for other sectors such as automotive and online education. By expanding the scope of this project, we can continue to drive innovation and improve customer experiences across multiple industries.

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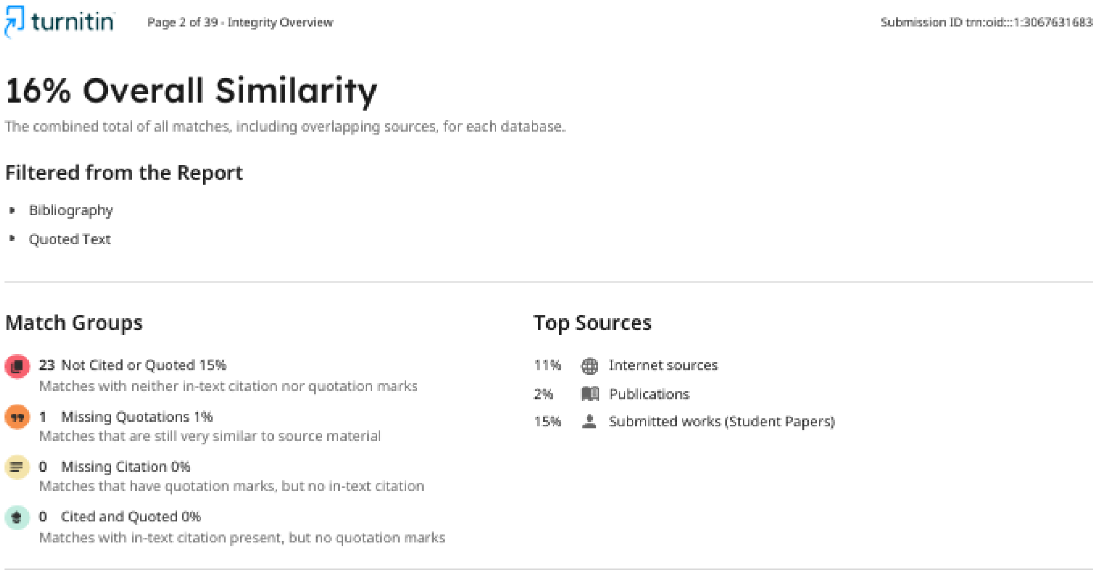
APPENDIX A

PLAGIARISM REPORT



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